



## Methods of Electricity Production and Improvement of Production Efficiency

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**Abstract:** In this article, a brief history of the emergence of electricity, the development of the energy sector in Uzbekistan, types of energy, production methods, the amount of energy production over the years, and the activities of large electricity organizations in the country are briefly discussed.

**Key words:** energy, electric energy, power plant, meter, telemetric sensor, billing cycle, NPP, HPP, QaES, SHES, OES, GaES, innovative technologies.

**Enter.** In the course of human development, people's needs for various sources of energy forced them to use natural sources - wood, coal, peat, etc., as well as wind and water flow energy (mills, wind and water mills). Later, due to the development of science and technology, the scientific and technical revolution, from the second half of the 20th century, the need for electricity increased. These factors required the rapid development of energy industry. The development of science and technology is expressed through the development of new methods of energy production and its transformation, the creation of new efficient equipment and technologies, the centralization of energy distribution, etc. The science of energetics deals with the issues of converting the potential energy of natural energy resources into usable and useful types of energy in the national economy and solving related scientific and technical problems. Electric power is the field of production, transmission, distribution, sale and consumption of electric energy.

When dealing with energy problems, the laws of energy development, natural traditions and optimal solutions are studied based on consistent scientific research, the foundations of optimal energy management are formed, complex problems of energy, including its impact on the environment, i.e. ecological issues, issues of energy science and technology development and others are resolved. The development of energy sciences in Uzbekistan corresponds to the end of the 30s and 40s of the 20th century. Scientific research work on energy was focused on solving priority complex issues and practical problems of energy.

The issue related to the long-distance transmission of electric energy - the theory of converting alternating current into direct current, calculation methods for ensuring the self-excitation of magnetic currents of asynchronous and synchronous machines, development of the theory of complex types of damage in electronic devices, and solving the efficient distribution of power of hydroelectric power

plants were dealt with. related works have been completed. In the late 1940s and 1950s, scientific research was focused on improving the operation of power plants, electrical systems and equipment, improving their accuracy, increasing their efficiency, and creating a compact theory and methods of calculating electrical systems. The problems of solving large-scale nonlinear equations representing the mode of electrical systems, creating schemes for extracting small power from high-voltage power lines, developing calculation theory and methods were studied.

**Analysis of literature on the topic.** Researchers and researchers systematically conducted research on the methods of electricity generation, including Avaz Orinboev, deputy of the Legislative Chamber of the Oliy Majlis, and others. Taking into account the above ideas, additional suggestions were made about the methods of electricity production.

**Research methodology.** Logical analysis methods based on information were used in the research process. Methods and approaches such as space and time, analysis and synthesis are also used.

**Analysis and results.** In order to rationally use the natural climatic conditions for the development of Uzbekistan's energy industry, extensive research has been conducted on the use of renewable energy sources, in particular, solar energy, wind power, groundwater temperature, and small hydroelectric power plants. Important research was carried out to achieve scientific results such as automation and telemechanization of energy processes and measurement techniques in energy systems, improvement of measurement accuracy, accuracy and efficiency.

The energy sector includes thermal energy, hydropower, nuclear energy, wind energy, solar energy, magnetic fluid energy, wave energy, ocean thermoelectric energy, wave energy, geothermal energy, biomass energy and other energy production methods.

a. Heat energy production: use the heat generated by burning coal, oil, natural gas and other fuels to heat the water in the boiler water pipe into high temperature and high pressure steam and rotate the steam turbine, thereby driving. generator to produce electricity.

b. Hydroelectric power generation: the potential energy of water flowing from a high place to a low place is converted into kinetic energy by a dam. It can turn a generator to convert mechanical energy into electrical energy.

c. Nuclear energy production: Using the energy produced during the fission of atomic nuclei, water in a reactor is heated to produce steam. A steam driven steam turbine turns a generator to produce electricity.

d. Wind Power Generation: Use the wind to drive windmills to drive generators to generate electricity; solar thermal energy generation: use heat collectors to collect solar thermal energy and heat water in water pipes to produce steam, which in turn drives turbine generators to produce electricity.

e. Solar energy production: Solar panels are made of silicon materials with photoelectric effect and light energy is converted into electricity by receiving solar energy radiation.

In the Republic of Uzbekistan in January-October 2021, 57,070.7 million kwh of electricity was produced. Compared to the corresponding period of the previous year, the production volume of electricity was 4926.2 mln. The rate of growth was 109.4 percent, per kWt.

**In 2021, the production of electric energy in place of information:**

Intermediate term	Amount of energy (kw/h)	Growth rate (%)
january	6 427,7	106,0
January-February	11 951,4	104,3
January-March	17 987,4	106,1
January-April	23 528,4	108,5

January-May	28 809,1	109,0
January-June	34 318,6	109,1
January-July	40 340,0	109,2
January-August	46 030,9	109,0
January-September	51 558,4	110,1

Tashkent region has 23.1% share, Syrdarya region 22.2%, Kashkadarya region 19.0% and Navoi region 16.1% of the total amount of electricity produced by electricity producing enterprises on a national scale.

According to the Ministry, in January-July of this year, 43 billion 250 million kWh were produced in the republic, or 2 billion 177 million kWh more than in the same period last year (growth rate 5, 3 percent) of electricity was produced. 38 billion 551 million kw/h (1 billion 18 million kw/h more than last year, growth rate 2.7 percent) in thermal power plants and centers produced. In particular, "Heat power stations" - 33 billion 77 million kWh, Angren IES and New Angren IES - 3 billion 345 million kWh.

In addition, 2 billion 128 million kwh in new thermal power plants based on PPP, 219 million kwh by solar photoelectric stations based on PPP, and 4 billion 84 million kwh in hydropower plants (898 million kwh more) The Ministry of Energy is implementing projects on increasing capacity, including stable electricity supply. In December 2020, 1.74 billion kwh were supplied to the population of Uzbekistan, and in December 2018 (before the establishment of the Ministry of Energy) - 1.57 billion kwh /hour of electricity delivered. The increase was 11%.

In general, in 2020, the consumption of electricity throughout our country was 69.1 billion kwh, which is 6.1% more than in 2019 and 20.1% more than in 2016. In 2020, 66 power plants of our country .4 billion kWh of electricity was developed, which is 5% more than in 2019 and 12.6% more than in 2016.

The production of additional electricity in our country is carried out due to the implementation of investment projects on the expansion of generating capacity. All of them are based on modern energy-saving technologies.

In particular, more than 3.7 GW of capacity was launched at the expense of loans based on state guarantees due to the implementation of projects provided for in the Investment Program adopted in 2016. This was achieved due to the construction and modernization of a number of power plants. In this way, 900 MW of new capacities were obtained from Tolimarjon IES, 560 MW - Takhyatosh IES, 450 MW - Navoi IES, 370 MW - Tashkent IEM, 150 MW from the coal power unit at Angren IES. That is, 1 new power plant, 4 new hydroelectric power plants were built, and expansion of existing power plants was carried out.

The new Torakorgon thermal power station, built in Namangan region, produces half of the electricity consumed by three regions of the Fergana valley today. Prior to the commissioning of the Torakorgon TPP, the energy supply of the Fergana Valley was carried out only at the expense of electricity imported from other regions of Uzbekistan and the Kyrgyz Republic. If the projects provided for in the investment program are fully implemented, our country will produce 21 billion kWh more electricity than in 2016. In addition, energy-efficient technologies used in the modernization of existing power plants and construction of new ones make it possible to reduce fuel costs by 1% per 1 kW/h.

As a result, an average of 2 billion cubic meters of natural gas will be saved in the development of electricity. In 2020 itself, the construction of six new power plants was started on the basis of public-private partnership with foreign investors. Their total cost is 2 billion dollars, and the total capacity is 2,700 MW. 2020 As a result of the implementation of investment project stages in 2021, 9 new power plants with a capacity of 1,387 MW will be launched in our country. In October and November of this year, 4 new thermal power plants with a capacity of 940 MW will be built in cooperation with Turkish companies.

It is also planned to launch two solar power plants with a capacity of 100 MW each in October of this year (Total Eren (France) in Samarkand region, Masdar (UAE) in Navoi region are implementing their projects.

A number of projects are also being implemented in the field of hydropower. In June 2021, the construction of the "Kamolot" hydroelectric power station, which is part of the Chirchik - Bozsuv cascade of hydroelectric power stations, will be completed. Also, in June, the Zarchob small hydroelectric power station cascade is planned to be launched on the Topolong river in the Surkhandarya region, the press service of the Ministry of Energy reports.

The Ministry of Energy of the Republic of Uzbekistan published an infographic of electricity produced over the last six years. According to it, in our country:

- 2016 - 59.0 billion. kWh;
- 2017 - 60.7 billion. kWh;
- 2018 - 62.8 billion. kWh;
- 2019 - 63.6 billion. kWh;
- 2020 - 66.4 billion. kWh;
- 2021 - 71.3 billion. kWh;
- 2022 - 74.3 billion. kWh of electricity produced.

All resources are used in the development of the energy system in our country. In addition to strengthening the existing capacities, solar, wind and hydroelectric facilities are being built. In particular, in recent years, 27 projects worth 500 million dollars have been implemented in the field of hydropower, and additional capacities of 260 mwt have been created. capacity exceeded 2 thousand megawatts. This means that 2 billion cubic meters of natural gas is saved per year. This year, 7 projects of 197 mwt and 10 micro hydropower plants are planned to be put into operation. Work on the construction of 8 promising projects with a capacity of 438 mwt and 50 micro hydroelectric power stations will begin. In order to improve the electricity supply of consumers of Sirdarya and Jizzakh regions, the first high-voltage digital substation and power transmission network are being built. In order to improve the electricity supply of the consumers of Shirin, Yangiyer, Khovos districts of Syrdarya region, Zomin, Zarbdor and Zafarabad districts of Jizzakh region, a new number one "Zafarabad" substation with a voltage of 220 kV is being built by JSC National Electric Networks of Uzbekistan. Also, a 144-kilometer long 220 k/W power transmission network is being built for this substation. Today, 42% of the construction works have been completed. This major project is being implemented based on the decision of the President of December 28, 2022, the press service of the Ministry of Energy reports.

**Conclusions and suggestions.** From July 1, prices for electricity and gas consumption are expected to be determined on the basis of "social norm". According to the draft government decision published for discussion, the current prices will increase. Also, those who use more than the specified rate will pay 2 times for each additional kWh of electricity, and 5 times for each additional cubic meter of gas. The prices will be indexed to the inflation level from 2024-2025, and will be liberalized from 2026. Consumption of 1 cubic meter of natural gas for the population per month in the heating season up to 700 cubic meters — 410 soums, for every 1 cubic meter above that — 1,200 soums, heating in the off-season, it is planned to set the price for up to 200 cubic meters - 410 soums, and for every 1 cubic meter above - 1,200 soums.

The project also proposes to approve new prices that will come into effect on April 1, 2023, in order to align enterprises to long-term planning, increase operational efficiency and energy efficiency, and show a "prospective target" for reducing costs.

In this case, the following prices will be introduced from April 1, 2023:

On electricity:

The price of 800 soums will be kept for Navoiy KMK, Almalyk KMK and budget organizations;  
for other legal entities - 700 soums.

For natural gas:

for thermal power plants - 1,200 soums;

For Navoi KMK, Almalyk KMK and budget organizations - 1,350 soums;

for filling cars with gas compressor stations - 1,400 soums;

for other legal entities - 1,350 soums.

It was planned that the prices of fuel and energy resources, which will be established from April 1, 2023, will be indexed only to the level of inflation in 2024 and 2025, and from 2026, it will be transferred to the wholesale market of electricity, natural and liquefied gas, and prices will be formed freely. However, due to the strong cold climate in the autumn-winter season of 2022-2023, there was a shortage of energy resources, and the price rose sharply. This is causing a number of changes in all sectors of the economy.

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